COMP 3850 - Assignment 3

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Question 1:

Final Weight Matrix Obtained = [0 0 0 -2 2 -2 0 0 0]

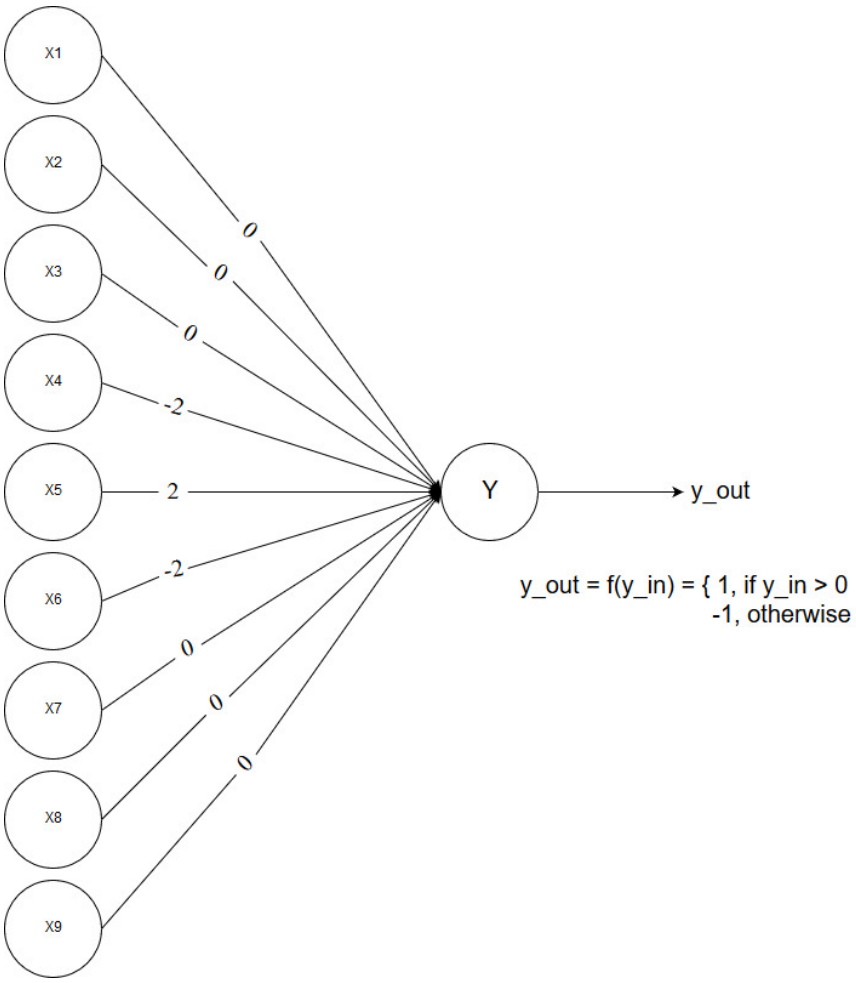

Figure 1: Heb Net for Differentiating Between I and O patterns

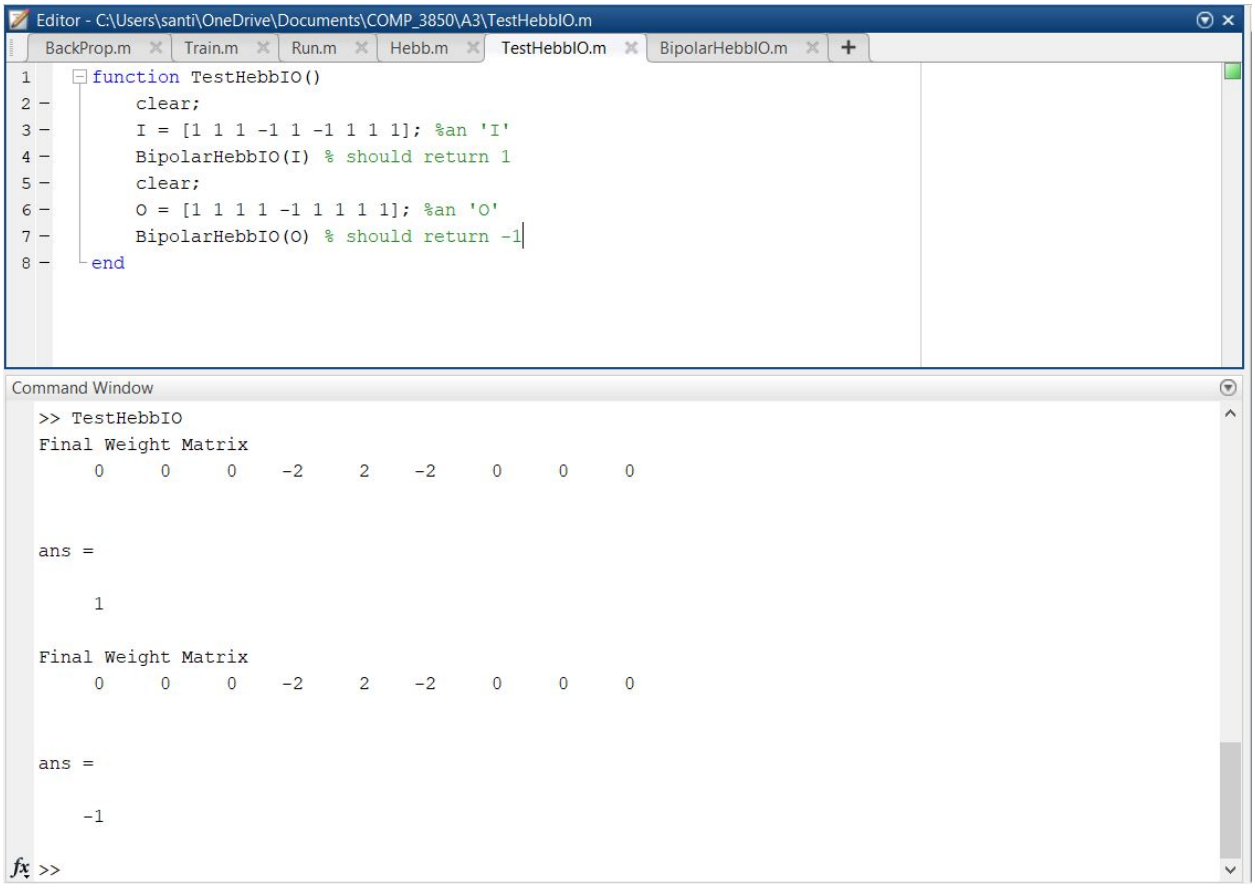

Figure 2: Snippet of Hebb Net In MATLAB

Question 2:

Input pattern used: $[0,\ 1]$

Learning Rate, $\alpha\ =\ 0.25$

Desired output, $d\ =\ 1$

Usinng Binary Sigmoid as activation function:

$\phi = \frac{1}{1\ +\ e^{-x}}$

$\phi' = (\phi)\,(1 - \phi)$

Forward Pass:

Input layer to middle layer:

$Z_1in\ =\ (0)\,(0.6)\ +\ (1)\,(0.1)\ +\ (1)\,(0.3)\ =\ 0.4$

$Z_2in\ =\ (1)\,(0.4)\ +\ (0)\,(0.3)\ +\ (1)\,(0.5)\ = 0.9$

Hidden Layer:

$Z_1out = \frac{1}{1\ +\ e^{-0.2}}\ =\ 0.5498339973$

$Z_2out = \frac{1}{1\ +\ e^{-0.9}}\ =\ 0.7109495026$

Output layer:

$Yin\ =\ (0.5498339973)\,(0.4)\ +\ (0.7109495026)\,(0.1)\ =\ 0.09102854918$

$Yout\ =\ \frac{1}{1\ +\ e^{-0.09102854918}}\ =\ 0.5227414361$

Backward Pass:

Output Layer:

$e\ =\ d\ -\ y\ =\ 1\ -\ 0.5227414361\ =\ 0.4772585639$

$\delta\ =\ 0.5227414361\,(1 - 0.5227414361)\,(0.4772585639)\ =\ 0.1190678158$

Hidden Layer:

$e_{11}\ =\ (0.4)\,(0.1190678158)\ =\ 0.04762712632$

$\delta_{11}\ =\ (0.5498339973)\,(1 - 0.5498339973)\,(0.04762712632) =\ 0.01178850307$

$e_{12}\ =\ (0.1)\,(0.1190678158)\ =\ 0.01190678158$

$\delta_{12}\ =\ (0.7109495026)\,(1 - 0.7109495026)\,(0.01190678158) =\ 2.446885169 \times 10^{-3}$

Weight Updates:

Weights to Y :

$w_{01} = w_{01} + \alpha\delta x_{w_{01}} = 0.4 + (0.25)(0.1190678158)(0.5498339973) = 0.4163668833$

$w_{02} = 0.1 + (0.25)(0.1190678158)(0.7109495026) = 0.1211628011$

$w_{03} = -0.2 + (0.25)(0.1190678158)(1) = -0.1702330461$

Weights to Z_1 :

$w_{11} = 0.6 + (0.25)(0.01178850307)(0) = 0.6$

$w_{12} = -0.1 + (0.25)(0.01178850307)(1) = -0.09705287423$

$w_{13} = 0.3 + (0.25)(0.01178850307)(1) = 0.3029471258$

Weights to Z_2 :

$w_{21} = 0.4 + (0.25)\left(2.446885169 \times 10^{-3}\right)(1) = 0.4006117213$

$w_{22} = -0.3 + (0.25)\left(2.446885169 \times 10^{-3}\right)(0) = -0.3$

$w_{23} = 0.5 + (0.25)\left(2.446885169 \times 10^{-3}\right)(1) = 0.5006117213$

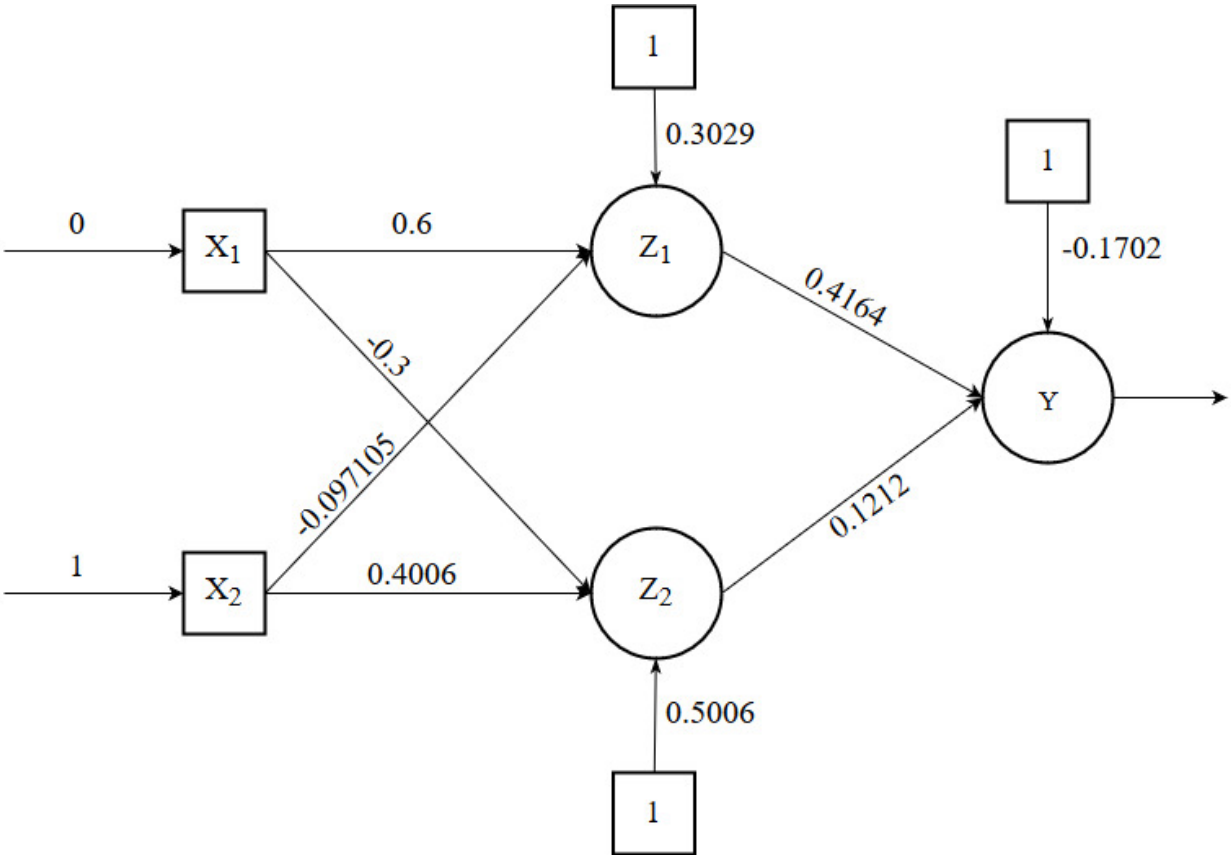

Figure 3: Net After 1 Epoch of Training